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REVIEW ARTICLE

# Breast fibroadenomas: a review in the light of current literature

## Gruczolakowłókniaki piersi: przegląd w świetle aktualnej literatury

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**ABSTRACT:**

**Introduction:** Fibroadenomas are one of the most common benign tumors of the breast in the adolescent females accounting for about ⅔rd of all the breast lumps and more than half of all the biopsied breast lesions. They come into being due to overgrowth of glandular tissue under the influence of hormonal changes that the girls undergo at the time of puberty. Due to the wide prevalence of fibroadenomas and the psychosocial morbidity associated with the finding of a breast mass, it is imperative for physicians treating adolescent patients to be thoroughly familiar and updated with this disease.

**Aim:** The article aims at providing a brief review of the classification, presentation, diagnosis, and update on the management of breast fibroadenomas on the basis of recent literature.

**KEYWORDS:** adolescence, benign breast neoplasm, breast lump, fibroadenoma, observation

**STRESZCZENIE:**

**Wprowadzenie:** Gruczolakowłókniaki są jednymi z najczęstszych łagodnych guzów piersi u kobiet w wieku dojrzewania. Stanowią one około ⅔ wszystkich guzków występujących w obrębie piersi i ponad połowę wszystkich zmian poddawanych biopsji. Gruczolakowłókniaki powstają w wyniku przerostu tkanki gruczołowej pod wpływem zmian hormonalnych, jakie zachodzą u dziewcząt w okresie pokwitania. Ze względu na dużą częstość występowania gruczolakowłókniaków i wysoką chorobowość psychospołeczną związaną ze stwierdzaniem obecności masy w gruczole piersiowym, konieczne jest, aby lekarze leczący pacjentki w wieku dojrzewania posiadali i aktualizowali swoja wiedzę na temat tego schorzenia.

**Cel:** Celem niniejszego artykułu jest przedstawienie krótkiego przeglądu klasyfikacji, prezentacji klinicznej i diagnostyki gruczolakowłókniaków oraz aktualizacja opisu praktyk postępowania z pacjentkami w świetle najnowszej literatury.

**SŁOWA KLUCZOWE:** dojrzewanie, gruczolakowłókniak, guzek piersiowy, łagodny nowotwór piersi, obserwacja

## ABBREVIATIONS

**BMI** – body mass index
**CAR** – complete ablation rate
**DPA** – docosapentaenoic acid
**EABS** – endoscopy-assisted breast surgery
**EPA** – eicosapentaenoic acid
**GFA** – giant fibroadenoma
**HIFU** – high intensity focused ultrasound
**HRD** – hormone-replacement therapies
**MDRAI** – modified double ring areolar incision
**MRI** – magnetic resonance imaging
**MWA** – microwave ablation
**RF** – radiofrequency
**RFA** – radiofrequency ablation
**US** – ultrasound
**VAB** – vacuum-assisted percutaneous therapeutic excisional biopsy

## INTRODUCTION

Fibroadenomas are the most common breast masses in adolescent females [1–3] with an overall incidence of about 2.2% [2]. They account for 68% of all breast masses and 44–94% of biopsied breast lesions [4]. In the term, fibroadenoma "fibro" means the stromal tissue, "adenoma" means the glandular structural in epithelial tissue and "oma" simply means tumor inferring thereby that histologically, fibroadenoma is a benign biphasic tumor with epithelial and stromal components [5]. The goal of this article is to provide an update on clinical presentation, diagnosis and the management of breast fibroadenoma in the light of the recent literature.

## METHODS

The original articles and case reports dealing with the fibroadenomawere reviewed in PubMed, ResearchGate HINARI, Google Scholar and Web of Science after search on the keywords: Breast fibroadenoma, Benign breast disorders and Breast Masses in adolescence. Preference was given to the literature published in English and time limits were set from January 2000 to September 2020.

## CLINICAL PRESENTATION AND EPIDEMIOLOGY

Fibroadenomas are most common in women in their 20 s and 30 s, but they can be found in women of any age. It is estimated that about 10% of the world's female population suffer from fibroadenoma once in a lifetime. The peak age for fibroadenoma in Caucasian women is in their 20 s whereas in African, American, Hispanic and

other women of colour, it is found earlier in late teens [2, 4]. Fibroadenomas present in adolescents as firm rubbery, nontender, smooth, mobile, clearly demarcated masses usually 2 to 3 cm in size, though they may range from less than 1 cm to greater than 10 cm [6]. Although they can be located anywhere in the breast, there is a predilection for the upper outer quadrant. More than 70% are solitary lesions and the rest occur as multiple masses in one or both breasts [6]. Due to their hormonal sensitivity, fibroadenomas may fluctuate with the menstrual cycle, commonly enlarge during pregnancy and involute at menopause. Hence, they rarely present after the age of 40 years. However, with the wide use of hormone-replacement therapies (HRT), the prevalence of fibroadenoma has increased in that age group, too in recent times [3]. Fibroadenomas are not fixed to the surrounding parenchyma and slip around under the palpating fingers, hence they are known by a colloquial term of a breast "mouse".

They lesion may enlarge slowly without causing any pain or any nipple and skin changes though the discovery of a breast lump in a teenager may create anxiety and worry in the patient and the family [2]. However, in certain variants as explained below, pain of mild to moderate intensity may be felt. Furthermore, the lesion can cause significant breast asymmetry and aesthetic deformation of the breast.

## CLASSIFICATION

Fibroadenomas have been classified into three clinical variants:

### Simple fibroadenoma

This is the commonest type of fibroadenoma and 70–90% of belong to this category. The features are described above in the Clinical Presentation section.

### Juvenile fibroadenoma

Juvenile fibroadenomas account for 7 to 8% of all fibroadenomas. This variant is mostly prevalent among African American adolescents, and presents as rapidly growing bilateral lumps with associated skin ulcerations and prominent veins [7]. The term 'cellular fibroadenoma' is sometimes used to refer to juvenile fibroadenomas.

Giant juvenile fibroadenomas are a rare subvariant of juvenile fibroadenoma with an incidence of approximately 0.5–2% of all fibroadenomas but considered as the most common cause of unilateral macromastia in adolescent women. They are rapidly enlarging encapsulated fibroadenoma with a diameter greater than 5 cm, weighing over 500 g, or displacing at least four fifths of the breast [8–10].

Giant fibroadenomas are associated with skin ulcerations and venous engorgement and are very rarely bilateral [11]. The populations susceptible to giant fibroadenomas are African-American women aged 10–18 years old.

### Multicentric fibroadenoma

Multicentric fibroadenomas are multiple fibroadenomas located at different quadrants of the breast. The incidence of multicentric fibroadenoma is approximately 10–25% of all fibroadenomas [12].

The average number of masses in cases of multiple fibroadenomas is usually 3 to 4 in a single breast and the occurrence of more than five fibroadenomas in an individual patient is much less common.

## HISTOPATHOLOGY

On gross examination, fibroadenoma specimen appears as a firm, well circumscribed, grey-white or tan, ovoid mass with bosselated surface with slit-like spaces and lobulations bulging above the cut surface. Calcification may also be present and some specimen may have mucoid or fibrotic appearance.

On microscopic analysis, fibroadenoma is composed of a biplastic proliferation of both stromal and epithelial components [13].

This biplasia can be arranged in two growth patterns:

1. Pericanalicular: Includes the proliferation of stromal cells around epithelial structures;
2. Intracanalicular: Includes the proliferation of stromal cells compressing epithelial structures into clefts.

Fibroadenomas characteristically display hypovascular stroma that distinguish them from malignant neoplasms. Furthermore, the epithelial proliferation appears in a single terminal ductal unit and describes duct-like spaces surrounded by a fibroblastic stroma. The basement membrane is intact. Fibroadenoma harboring epithelial calcifications. papillary apocrine metaplasia. sclerosing adenosis and/or cysts larger than 3 mm, are termed as complex fibroadenoma.

## NATURAL HISTORY

The natural history of fibroadenoma varies from individual to individual. Some fibroadenomas may remain dormant without any change in size and others may grow slowly in size. Overall, with time, most fibroadenomas decrease in size as they lose cellularity, infarct with resultant calcification and hyalinization. In the adolescent population, 10–40% of fibroadenomas have been found to spontaneously regress [2, 4].

## ETIOLOGY

Fibroadenomas are a stromal and epithelial proliferation arising from the terminal duct-lobular unit and their exact etiology is unknown. However, several studies show that the development of fibroadenomas is influenced by the estrogen levels.

Coriaty Nelson Z. et al. undertook a large population study of 265,402 women and found that the risk of fibroadenoma was highest in women under 35 years of age, and it decreased with age after 35 and dropped significantly at the time of menopause [14]. The risk decreased with increasing number of livebirths and with duration of oral contraceptive use and increased with number of prior benign breast lesions and with decreasing age at the first benign lesion. The development and persistence of fibroadenomas was found to be dependent on the presence of ovarian hormones, and full-term pregnancies and exposure to exogenous estrogen-progesterone

combinations before menopause may reduce risk by enhancing differentiation or reducing estrogen-induced proliferation in the mammary epithelium [14].

Sapino et al. studied the expression of estrogen receptor (ER)-α & -β was investigated by immunohistochemistry and the presence of ER-β mRNA and its variants was evaluated by RT-PCR in 33 fibroadenomas and it was concluded that a hormone-receptor mechanism may be involved in regulating the growth of fibroadenomas [15]. Lim W.K. et al. undertook exome sequencing of eight fibroadenomas with matching whole-blood samples and found recurrent somatic mutations solely in MED12, which encodes a Mediator complex subunit and thereby concluded that the fibroadenomas and the benign tumors of uterus, both of which are key target tissues of estrogen, may share a common genetic basis underpinned by highly frequent and specific MED12 mutations [16]. Xie et al. performed whole exome sequencing of 12 fibroadenomas and the corresponding normal breast tissues in Chinese Han population and observed the somatic and germline landscapes of genetic alterations [17].

O'Brien and Kowdley concluded from a study of 1,717 patients that there is a correlation between body mass index (BMI) and the incidence of fibroadenoma and that the incidence of fibroadenoma peaked in the BMI group of 25–29.9 kg/m$^2$ [18]. Fibroadenomas have also been reported to be associated with syndromes such as idiopathic hemihypertrophy, Beckwith-Wiedemann syndrome, Maffucci syndrome, and Cowden syndrome [19–20]. There are also published reports of development of bilateral multiple breast fibroadenomas secondary to cyclosporine-A therapy post renal transplantation [21–22].

Multiple fibroadenomas has also been associated to a strong history of breast lesions in the family and it has been suggested that the physiologic level of estrogen in such patients did not increase, but instead, the number of estrogen receptor increased leading to hypersensitivity of local breast tissue to estrogen [23–25].

Various studies have been conducted to study any potential influence of dietary habits on fibroadenoma. Dijkstra et al. examined possible associations between a broad spectrum of circulating biomarkers of dietary intake and the risk of fibroadenomas and observed inverse associations between higher percentages of the eicosapentaenoic acid (EPA) and docosapentaenoic acid (DPA) and fibroadenoma risk suggesting thereby that the higher intakes of soy foods and fatty fish may lower the risk of fibroadenomas [26]. Nelson et al. found that a diet rich in fruits and vegetables and the use of oral contraceptives may reduce risk of fibroadenoma [27].

## RELATION OF FIBROADENOMA WITH BREAST CANCER

Carcinoma developing in a fibroadenoma is rare and is most often diagnosed incidentally on post-operative examination of excision biopsy specimens; the rate varies from 0.002% to 0.125% [28–31].

There are certain reports published in the literature where malignancies were diagnosed within a screening programme as a result of suspicious mammographic findings, and the diagnosis was confirmed preoperatively by core biopsy in all cases [32].

Very recently Shiino et al published a case of invasive ductal carcinoma in fibroadenoma of triple negative phenotype with multiple lymph node metastases that achieved pathological complete response [33].

The reported mean age of cancer in various case series is 42.5 years, which is about 20 years later than the peak age of occurrence of fibroadenoma thereby implying that there ought to be a high suspicion index for malignancy in fibroadenomas occurring in older women particularly in the ones with associated risk factors like strong family history. A carcinoma occurring in a fibroadenoma may be considered a chance occurrence as the epithelial component of a fibroadenoma is subjected to the same stimuli and triggers as rest of the breast. The carcinoma may arise in an adjacent breast tissue engulfing or infiltrating a fibroadenoma or else be restricted entirely, or at least dominantly, to a fibroadenoma [34].

## EVALUATION AND ASSESSMENT

Adolescents presenting with a breast mass should have the diagnosis on the basis of the combination of careful clinical examination, imaging and pathological analysis (the triple assessment). Clear communication and reassurance are critical as any breast mass in this patient population will cause significant anxiety to the patient.

History should include age when the breast mass was first noted, changes in the size and texture of the mass, association with the menstrual cycle, associated pain, breast skin changes, nipple discharge and the occurrence of additional masses. The physician should also enquire about the age of menarche, pregnancy history, prior breast mass, radiotherapy, or malignancy, and the family history of breast or ovarian malignancies.

Physical examination should include a detailed breast examination and palpation of the axillary lymph nodes. For palpable masses, the size, location, consistency, mobility and any associated skin changes should be documented. An attempt should be made to express discharge through the nipple.

Imaging options include mammography, ultrasound, and magnetic resonance imaging (MRI). However, as the patients are generally adolescent, ultrasound is the best option due to the density of the adolescent breast. The characteristic appearance of a fibroadenoma on sonographic evaluation is an ovoid smooth solid mass, narrower in its anteroposterior diameter than its transverse diameter, with even, low-level internal echoes; however, complex presentations that overlap malignant masses are also detectable including no circumscribed margin, lobulation, presence of a posterior shadow, heterogenicity, and micro calcification [35–36].

Juvenile fibroadenomas frequently show posterior acoustic enhancement and hypervascularity on colour Doppler sonography [37]. Complex FAs, in comparison with simple FAs, tend to have more aggressive features and to be in higher BI-RADS categories on ultrasonography [38]. For pathological analysis, ultrasound guided fine needle aspiration or core needle biopsy may be done, but these techniques present iatrogenic risks in the developing breast [7, 39].

## DIFFERENTIAL DIAGNOSIS

Fibroadenoma must be differentiated from other diseases that cause a similar clinical presentation including inflammatory lumps, lipomas, hamartomas, breast cysts, galactocele, diabetic mastopathy, fat necrosis, benign juvenile breast hypertrophy, and malignancy.

## MANAGEMENT

Management of fibroadenomas varies from observation to open surgical excision. The intervention and the associated risks should not be taken lightly, and it is critical to carefully decide when to intervene versus when to observe because any intervention even as small as a biopsy may cause iatrogenic injury to the developing breast bud and result in permanent aesthetic deformity and disfigurement of the breast [40].

## OBSERVATION

Fibroadenomas that are asymptomatic and neither rapidly enlarging nor causing any cosmetic deformity may be observed with yearly breast examination and ultrasound if necessary. Patient should be counselled and reassured about the safety of conservative approach and informed about the very low probability for the lesion to turn malignant. However, if the patient does not feel comfortable with conservative approach, and if the fear of malignancy is causing significant anxiety, asymptomatic fibroadenoma should be removed though it is advisable to observe for at least 3–4 months before intervention [6].

## INTERVENTION

This is indicated for the fibroadenomas that are greater than 5 cm in diameter, increasing in size, causing considerable pain, distorting the breast parenchyma, causing cosmetic deformity of the breast, persisting without any regression or when there are features in imaging or pathology that require malignancy to be ruled out [4].

## MINIMALLY INVASIVE TECHNIQUES

Due to the development in medical technology, minimally invasive procedures have evolved in recent years. In general, such interventions result in significantly reduced breast scars, shorter hospitalization and less pain, but they require specific, expensive devices, longer surgical time compared to open surgery [41].

## VACUUM-ASSISTED PERCUTANEOUS BIOPSY (VAB)

Vacuum-assisted percutaneous therapeutic excisional biopsy (VAB) under local anaesthesia for the management of fibroadenomas up to 3 cm in size has been found to be highly effective in various series published in the recent years. It is considered a major step on the way towards minimal invasive surgery, which may be comparable to open surgery versus laparoscopy in gallstone treatment.

The procedure is undertaken under ultrasound or stereotactic guidance and involves multiple percutaneous passes of a hollow bore needle. The breast tissue is then subsequently aspirated via vacuum suction. The procedure is accomplished when the breast mass appears to be radiographically completely removed [42].

Papathemelis et al. [43] achieved complete fibroadenomectomy in 76% of cases and compared to fibroadenomas larger than 2.51 $cm^3$ (59%), those smaller than 2.5 $cm^3$ were completely removed more often (87.6%; $p < 0.05$). Mathew et al. reported complete excision in 56 fibroadenomas [44].

The procedure is associated with very little pain during and after biopsy and minimal haematoma development, both factors supporting a high rate of acceptance among patients. Wang et al. demonstrated a recurrence rate of 3.4% seen on ultrasound at 6 months post procedure [45].

Sperber et al. [39] achieved complete excision in all lesions less than or equal to 1.5 cm (mean volume, 0.25 mL) and in the lesions measuring 1.5 to 2.0 cm, 55% were completely excised. The volume of all completely excised lesions was less than 0.9 mL.

The most common complications are bruises, haemorrhage and hematoma, occurring at a rate of 0–13%. Furthermore, this procedure does not provide surgical margins since the tumor is removed piecemeal through core biopsies [46]. Grady et al. found that 75% of patients reported no pain, the remaining ones reported but moderate pain during the procedure [47]. Thurley et al. in a survey of 134 patients, noted that only 55% of patients reported pain that could be rated 3/10 in visual analogue scale of 1–10, within up to one week after the procedure. The post-biopsy scar was acceptable for all patients and after a year, hardly noticeable in 40% of them. 85% of patients assessed the cosmetic effect as good and 94% of the respondents reported that they would recommend this procedure to others and preferred the procedure to surgical excision [48]. Polom et al. found this technique to be highly effective combination of the features of a lesion resection and histopathologic material collection providing an access with minimum invasiveness [49]. Yom et al. found the results of the long-term follow-up of VAB excisions to be comparable to conventional methods [50].

## PERCUTANEOUS RADIOFREQUENCY-ASSISTED EXCISION

Percutaneous ultrasound- or stereotactic-guided, radiofrequency--assisted excision of fibroadenomas of the breast is a recent advance in office-based fibroadenoma management. This tool demonstrates excellent therapeutic accuracy comparable with that of VAB, a high rate of complete lesion removal with the potential for margin assessment, and is generally quick with minimal complications, provided there is sufficient training and careful case selection [51].

The procedure may be performed in an ambulatory setting under local anaesthesia. One or several 3–5 mm small skin incisions are made and a biopsy wand is inserted under ultrasound guidance, and advanced towards the lesion with the aid of radiofrequency (RF) cutting. When the tip of the wand is placed at the periphery of the lesion, the RF-enabled excision basket is deployed and the lesion is ensnared en bloc using RF cutting. The specimen is retrieved by

removal of the biopsy wand. gases and liquids collecting at the tip of the wand during the procedure are removed with vacuum suction. At the complete lesion removal is verified with post-procedure ultrasound. The procedure is well tolerated by patients and cosmetic outcomes are satisfactory. The complications are minimal and include bruises, nipple discharge, superficial skin burns and hematoma formation. Fine and Staren excised 106 diagnosed fibroadenomas with this technique and at the 4- to 6-month follow-up, 93% evaluable patients showed no physical or imaging evidence of residual fibroadenoma [52].

## ABLATIVE PROCEDURES

Fibroadenomas can also be removed by ablation within the breast by cold (cryotherapy) and heat (laser, radiofrequency, focused ultrasound and microwave). These are generally performed in the office under local anaesthesia [53–54].

## PERCUTANEOUS CRYOABLATION

Cryotherapy is conducted under ultrasound guidance with a table-top cryoablation system employing a 2.4-mm cryoprobe. The probe is placed percutaneously along the long axis of the fibroadenoma and then cooled by liquid nitrogen or argon gas to –160°C. Kaufman et al. used a treatment algorithm based on fibroadenoma size and all lesions were subjected to two freeze cycles with an interposing thaw [55].

The low temperature causes disruption of cell membranes, thrombosis of capillaries and hypoxia, which eventually causes destruction of the target fibroadenoma. The destroyed fibroadenoma is then gradually reabsorbed by the body. In situ destruction of the fibroadenoma reduces the risk of distortion of breast tissue and hence maintains the aesthetics and cosmesis. Furthermore, cryotherapy therapy results in minimal change to breast tissue on subsequent mammography [56].

In the series by Kaufman et al. [55], 57 core biopsy-proven benign fibroadenomas varying in diameter from 7 mm to 42 mm (mean 21 mm) were treated mostly in office-based setting using only local anaesthetic. Transient postoperative side effects were local swelling. Ecchymosis and mild postoperative discomfort. Lesions showed progressive shrinkage and disappearance over 3 to 12 months. No skin injury was noted and appearance remained excellent. Patient satisfaction was excellent [55]. Sheth et al. found Cryoablation treatment response to be inversely related to the tumor size, with lesions less than 2 cm showing an optimal response [57].

Hahn et al. [58] found that in 96% times, the patients and the physicians rated the cosmetic results of the procedure as excellent or good and in the series by Golatta et al. cosmetic results at 12 months follow-up were reported as good or excellent in 100% by physician and in 97% by patients [59].

## PERCUTANEOUS THERMOABLATION

Fibroadenomas can also be ablated with heat in different forms and many series have been published in the last two decades.

Dowlatshahi et al. reported placing a stereotactically guided laser needle within the fibroadenoma and use of a laser to generate heat, causing ablation of the tumor and a rim of normal breast tissue approximately 2.5–3.0 cm in size. At 6 years and 8 years of follow-up, both their patients, one with bilateral fibroadenomas, showed resolution [60].

Dosimetry planning and conformation of the treated area of fibroadenoma remain major issues, due to moving nature of the breast and pre-treatment simulation planning of this therapy is an effective method to predict the final thermal damage. Marqa et al. elaborated a mathematical model to simulate the heat distribution and the thermal damage thereby establishing a good correlation between simulation and ex vivo experiments of LITT for fibroadenoma breast cancer [61].

## HIGH INTENSITY FOCUSED ULTRASOUND

Another heat-based ablative technique for breast fibroadenomas is high intensity focused ultrasound (HIFU) [62]. Kovatcheva et al. presented a multicentric experience of treatment of 51 fibroadenomas with HIFU. At 12 months' follow-up of these cases, the mean volume reduction of 72.5% was documented [63]. Guillez et al. found HIFU to be a promising technique in the treatment of fibroadenomas with a volume decrease of approximately 50% at 6 months of therapy [64]. Peek et al. used US-guided HIFU under local anaesthesia in 20 patients on out-patient basis , by circumferential ablation technique instead of whole lesion ablation and found the reduction in the mean treatment time by 37.5% and reduction in mean fibroadenoma volume by 43.5% [65].

Li P et al. conducted a study in 2016 on 65 patients of fibroadenoma to evaluate the safety and efficacy of ultrasound (US) – guided percutaneous radiofrequency ablation (RFA) for multiple breast fibroadenoma as an alternative to surgical resection and concluded that due to advantages of high complete ablation rate (CAR), mild injury, rapid recovery, and cosmetic outcome desired by the patients, RFA has the potential to become the preferred method in the treatment of breast fibroadenoma [66].

Similar encouraging conclusion was drawn by Hahn et al. after treatment of 27 patients of symptomatic fibroadenomas [67].

## MICROWAVE ABLATION (MWA)

Percutaneous MWA treatment has in recent years emerged as another novel, safe, minimally invasive "patient-friendly" and efficient technique with a potential to be considered as an alternative first line treatment for benign breast lesions including fibroadenomas [68–69]. Xu J et al treated with MWA under US guidance, 56 patients having 107 biopsy-proved breast benign tumors, (mostly fibroadenomas) under local anaesthesia and achieved 93.3% volume reduction. Cosmetic satisfaction was reported excellent or good in 100% of patients [70].

Side effects common to various degrees in ablative procedures include superficial skin burns, hyperpigmentation over the treatment area, skin indurations, recurrence, incomplete removal, and inability to obtain clear surgical margins.

## SURGICAL EXCISION

Due to high prevalence and paucity of modern minimally invasive techniques, approximately 500,000 fibroadenomas still are managed by surgical excision each year. The aims and objectives of surgical excision is to completely enucleate the fibroadenoma with a rim of normal breast tissue while avoiding any resultant iatrogenic breast damage which has a potential to create unsightly scars and to hinder breast development causing breast asymmetry. The indications for surgical excision are unavailability of lesser invasive tools and presence of large-sized fibroadenomas that cause significant breast tissue distortion. Like in other general surgical operations, there are currently two approaches:

### Endoscopy-assisted breast surgery (EABS)

Minimally invasive Endoscopy-assisted breast surgery (EABS) techniques were developed in East Asia for the removal of breast both breast masses. Endoscopy was used in breast surgery initially by the plastic surgeons to evaluate for breast implant rupture or leakage of silicone but later on the scope widened to include tumor management [46].

In 2001, Kitamura et al. reported an experience of endoscopic extirpation of 36 benign breast tumors using an extramammary approach [71].

Three small incisions (5, 12, 2 mm) are made in the mid-axillary line, trocars are inserted, a space is created with a pre-peritoneal distention balloon and carbon dioxide is insufflated at 6 mmHg, followed by the dissection of the tumor and retrieval of the mass with an Endocatch bag either intact or piecemeal depending upon the size of the lesion.

Kitamura reported that the cosmetic results were excellent in all patients with no scars on the breast itself, but rather small scars in the mid-axillary line, which got concealed by the arm. Transient postoperative complications included subcutaneous emphysema to the neck and a superficial skin burn [71].

Cheng et al. reported the minimally invasive surgical technique in a small case series to excise giant juvenile fibroadenomas (5–10 cm in size). The operative technique involved the use of a single periareolar incision, dissection of the tumor free from the surrounding parenchyma, creation of flaps around the tumor, and subsequent retrieval of the specimen with an endoscopic plastic bag through the periareolar incision. The tumor was removed intact for 2 of 3 patients, and morcellated and removed piecemeal for one patient. In follow-up, all 3 patients have had excellent cosmetic outcomes, no recurrences, and no postoperative complications [72].

Lai H.W. et al. in 2017 present the results of EABS for 323 procedures including 202 fibroadenomas. The mean operative time was 81.4 min (59~89 min), which decreased with the increase in experience. The overall rate of complications was 6.5%, and all were minor and wound-related. Among the 110 patients who participated in the self-report cosmetic outcome evaluation, 85.4% reported being satisfied with the cosmetic result, and almost all were satisfied with breast symmetry. Of the patients interviewed, 92.7% reported that they would choose the same procedure if they had to undergo the operation again [73].

### Open approach

Open excision of fibroadenomas is still the most utilized technique for excision of fibroadenomas. It can be done under local or general anaesthesia primarily depending upon the size of the lesion.

All attempts are to be made to avoid the direct scars on the breast and incisions are to be placed in aesthetically concealed areas such as the circumareolar region or the inframammary crease.

The requirement for breast reconstruction after fibroadenoma excision depends on the size of the defect that gets created after tumor removal. Small defects that do not distort the breast architecture and hence do not require any reconstruction. For patients with secondary asymmetry, reconstruction is usually delayed until at least 1-year post excision or until the patient has reached skeletal maturity as there is a possibility that the developing breast parenchyma may expand to fill in the resulting defect and resolve any residual deformity [2].

For persistent deformities, techniques such as breast reduction, adjusting the excess breast skin envelope, breast implant insertion, and free nipple grafting have been used with success in various series [6].

For multicentric fibroadenomas, the surgical management may be troublesome for surgeons and patients and various innovative techniques have been suggested in recent literature. Lai et al. and Lovasic et al. in their respective series found the "round block" surgical technique can be performed effectively in all cases of multiple and multicentric fibroadenomas regardless of breast size, areolar diameter and the location of fibroadenoma in the breast [74–75].

Zhang et al. found that modified double ring areolar incision (MDRAI) offers greater advantages in the aspects of blood loss and recurrence for the treatment of breast benign tumor, especially for multicentric larger lesions [76]. Lee and Soltanian [6] have shown that early utilization of breast dermoglandular preserving reconstruction following giant fibroadenoma excision provides an excellent aesthetic outcome in the adolescent population.

Giant fibroadenomas also present difficulties in surgical management and various techniques have been proposed to minimise the cosmetic adverse outcomes. In a series of 27 patients with giant fibroadenoma (GFA) with a significant breast asymmetry, Achebe et al. found that excision through inverted "T" technique was successful in achieving postoperative symmetry with the opposite breast in these patients. Complications were minimal [77]. Tian et al. also reported this 'T' technique to be very effective [78].

Wang and Zhu very recently presented a new approach of mammotome-combined resection for excision of giant fibroadenomas with a minimal incision, thereby providing favourable contour to the breast [79]. They translated the larger mass to smaller one with the help of mammotome and removed it via a small circumareolar incision with no residual tumor.

## CONCLUSION

Fibroadenomas are one of the most common benign breast masses encountered in the adolescent population. Diagnosis of fibroadenoma should entail proper and detailed triple assessment. The discovery of

a breast lump has a potential to evoke anxiety and hence it is important to clearly communicate and reassure the patient throughout the treatment, of the predominantly benign nature of fibroadenoma and its natural course, the different surgical and nonsurgical approaches, and the need for continued follow-up after any procedure to determine if additional interventions are necessary. Management ranges from conservative in form of regular follow-up to surgical excision and breast reconstruction and before adopting any treatment modality, the risks and the benefits should be weighed carefully.

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